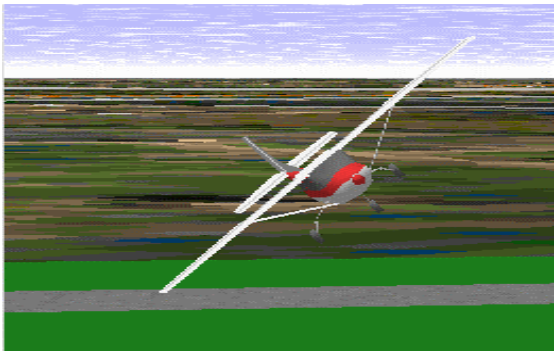
Systems Engineering

AFIT Systems Engineering Unmanned Aerial Vehicle (ASEUAV)

Research Areas

- systems design
- flight test engineering
- mission planning
- sensor integration
- aircraft control



Remote Control Flight Training

Recent findings

The AFIT systems engineering UAV program, sponsored by AETC's Education and Training Technologies Application Program (ETTAP), introduces an applied aircraft design project into the systems engineering course curriculum. We are finding that remote control model aircraft mission analysis and systems design are valuable tools for graduate engineering education.

Mission and system design project ideas are solicited from interested organizations.

Rear View

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Facilities and Equipment

Two Remote Control Aircraft
- Trainer (COTS)
- Multi-mission (Modified)
- Both 70" wingspan, 8-10 lbs gross weight

Two 6-Channel Radios with Trainer Cord
Mini Digital Video Camera Recorder
Remote Control Flight Simulator Software

Surveillance

System Engineering
Closely Supervised Reactive Control

Background

A closely supervised reactive system is a physical system that is or may be highly automated but which also has a human operator who: 1) maintains a high level of situational awareness of all of the autonomous operation
and intervenes in near real time as required and 2) manually performs task aspects for which he can be more effective than an autonomous controller. When configuring a controller for a physical system, what is delegated to manual versus automatic control can have enormous impact in system performance.

Applications

Two examples of existing AF applications include mission control of manned aircraft and control of the aerial refueling operation. Man-years of research have been devoted to giving the fighter pilot the most effective cockpit interface. For legacy systems, whether performance can be improved by changing the current mode of operation is the primary question. Examples of new AF applications include control of UAVs, SMVs and on-orbit satellite servicing. For new applications, the definition and the mix of manual and autonomous control have not been explored so thoroughly and is the primary issue.

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Facilities and Equipment

Establishing the proper control mix is challenging task because human performance is not readily predictable and hence, generally must be established using subject tests with hardware and/or software that emulates the proposed system. The Man-in-the-loop Laboratory contains a range of interfaces and simulation software for use in evaluating human response for specific applications. In addition, simulation facilities are available at Wright State and in AFRL/HE laboratories under sponsored UAV research programs.

KC-135 Refueling System

Predator Control Console

System Engineering
Dynamic Flight Simulation

Background

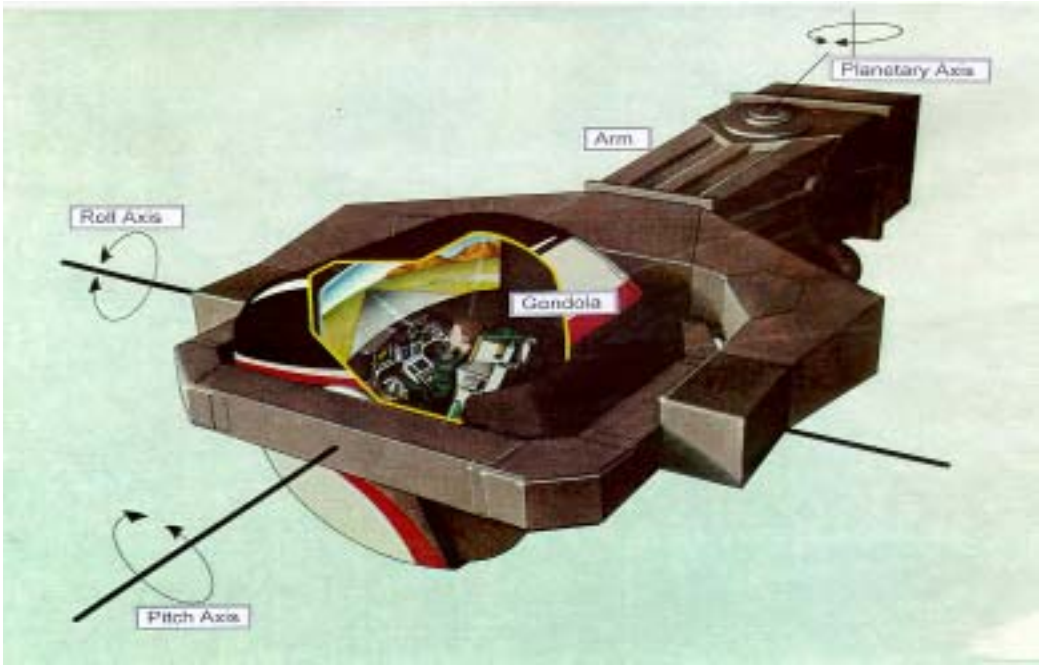
Motion-based flight simulation is currently accomplished with hexapod-type devices. However, they are not able to provide sustained acceleration levels due to stroke limitations of the linear actuators in each leg of the device. Centrifuge-based flight simulation, known as Dynamic flight simulation (DFS), offers the potential to provide sustained high-g flight simulation. Research is being conducted to determine the level of flight fidelity that can be achieved by DFS

Recent Findings

A fundamental limitation is the presence of angular acceleration artifacts produced when a centrifuge is operated as a high fidelity flight simulator. Centrifuge tests recently conducted to quantify human reaction to the short duration, large magnitude acceleration spikes that result during high fidelity DFS operation and the results indicate only mild disturbance over the expected range of g-loading and artifact magnitudes. DFS simulation of high performance aircraft appears feasible since artifact disturbance was observed to decrease as their duration was decreased

Facilities and Equipment

This research is being conducted via software simulation using Matlab software and model validation is being accomplished at the manufacturing site of Environmental Tectonics Corporation, the sponsor of this research.



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